CORROSION

Overview

A Proactive Approach to Preparing for Spring - the Rust Season.

The warm temperatures of Spring are always a welcomed change; however, along with warmer weather comes higher temperatures, higher humidity and, unfortunately, rust. Every year from May through September the metalworking industry is plagued with rust problems. Problems that are easily preventable with a proactive fluid maintenance approach.

With lower temperatures and humidity during the period of October through February, it's easy to become somewhat complacent about metalworking fluid maintenance. Some customers find that their concentrations fall outside of the recommended range, tramp oil levels increase, bacteria growth, hardness, chlorides and sulfates become elevated. Because of the mild environment there is no detrimental effect from rust, until Spring.

When May arrives, temperature and humidity climb and our telephone begins to ring, and ring, and ring. Customers are on the line with the same message, "I HAVE RUSTED PARTS." A mad scramble begins. The smooth, daily flow of activity is interrupted with more telephone calls, adjustments to production schedules, the reprocessing of rusted parts, returned parts, site visits … the list of non-value added activities can be endless. By putting preventative initiatives in place, rust problems and the scramble to correct them can be minimized. By addressing potential rust problems up front, your company can control quality, have fewer customer complaints and operate more efficiently. But, rust avoidance doesn't come without costs. It requires up front focus, dedication, time, resources, and sometimes production downtime. Only a thorough cost analysis will tell you which is best for your company—to put the effort in up front or to simply address rust issues as they arise.

In preparation of the upcoming rust season, for those of you who decide a proactive, up front initiative is best, there are some general guidelines and industry best practices to help you.

Best Practices Guidelines for Preventing Rust

How Rust Occurs.

Rust is the oxidation of a metal. For oxidation to occur, three things need to exist simultaneously to complete the corrosion circuit—a cathode, an anode and a carrier. In this circuit, the electrons flow from the cathode through the carrier (usually water) to the anode.

Eliminating Rust By Breaking the Corrosion Circuit

Eliminating any one part of the circuit will eliminate rust formation.

- The Anode is the part that requires protection; so eliminating this is not an option.
- The Cathode is a contaminate, usually in the form of an acid, salt, or alkali (bacteria, hard water, chlorides) that can be eliminated or controlled several ways:

1. Bacteria can be controlled by maintaining proper concentration and pH, minimizing tramp levels, continued fluid re-circulation, and biocide additions.
2. Hard water salts, chlorides and sulfates are related to incoming water quality. The level of these constituents can be controlled using a reverse osmosis (RO) or de-ionized (DI) water purification system. If incoming water quality is not controlled routine system dumps or partial dumps will be required.

A good practice is to maintain your fluid bacteria level below 10^4 CFU/ml. As the CFU/ml level approaches 10^7 and beyond, the probability of rust grows exponentially. Chlorides are very aggressive and one of the most notorious reasons for rust. Controlling this constituent is critical to having a rust-free season. There are two rules of thumb in the industry for maintaining an acceptable chloride level. First, keep chloride below 100 ppm -- anything above 100 ppm compromises your metalworking fluid's corrosion protection performance characteristics and is vulnerable to rust formation. Second, the collective chloride and sulfate levels should not be allowed to exceed 125 ppm. At 150 ppm you are at a dangerous

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state. Exceeding 175 ppm puts you at high risk and almost guarantees rust problems during the dog days of summer when temperatures rise above 90°F and humidity is high.

- The Carrier is water, usually from the metalworking fluid or atmospheric moisture. This can be eliminated or controlled several ways:

1. Blow offs are an effective way of removing excessive metalworking fluid, and usually more effective than heat/evaporation. When heat/evaporation is used, it allows the salts, chlorides and sulfates to remain on the surface.
2. Controlled atmosphere (air conditioning).
3. VCI bags and desiccant usage during storage and transportation.

Stopping the Corrosion Process

Keep in mind, once the corrosion cell starts and oxidation begins, the reaction mechanism will continue indefinitely. Even if conditions are improved, the reaction proceeds. For example, applying a rust preventive over top of the corrosion, placing rusted parts in a dry environment, re-washing the parts etc., will not fix the damage already done or stop the rust from continuing.

To remove rust and prevent further rust from forming, mechanical and/or chemical means must be employed. The rust must be removed down to the base metal and all surface contaminates must be removed as well. This is usually very expensive, labor intensive and time consuming.

Good Ongoing Maintenance Practices

Instituting or maintaining a good metalworking fluid maintenance program the can make a huge difference. The minimum maintenance recommended is:

1. First and foremost, maintain your fluid within the operating parameters recommended by your supplier. Concentration and pH monitoring are essential.
2. Test the fluid routinely. Test frequency is dependent upon numerous process parameters and can range from daily to monthly. Test for concentration*, pH, bacteria, hardness, chlorides, sulfates, and tramp oil.
3. Place parts in a storage area away from open doors, high forklift traffic areas, battery charging stations, and plating lines.
4. Allow data to drive fluid maintenance decisions.

*Note: Concentration test method ease and simplicity sacrifices accuracy. Generally, the preferred methods in their respective order are potentiometric titration, colorimetric titration, dropper method, and refractometer.

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